International Journal of Gerontology 7 (2013) 97–101

Contents lists available at SciVerse ScienceDirect

International Journal of Gerontology

journal homepage: www.ijge-online.com

Original Article

Social Participation and Life Expectancy—The Case of Older Adults in Taiwan from 1996 to 2003☆

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ARTICLE INFO

Article history:
Received 8 December 2011
Received in revised form
10 May 2012
Accepted 14 June 2012
Available online 25 August 2012

Keywords:
depression,
elderly,
life expectancy,
social participation

SUMMARY

Background: In 2009, 10.71% of the total population in Taiwan was aged 65 years or older. As societies develop, people, especially the elderly, seek both a longer duration and a better quality of life. Life expectancy is an indicator of quality of life. The purpose of this secondary analysis was to examine the effect of depressive symptoms on LE in the late life and to estimate the average number of years that elderly Taiwanese individuals can be expected to live, with and without social participation.

Method: This research applied a study design that used a longitudinal national survey with a multistage national probability sampling method. The Interpolation Markov Chain was used for data analysis.

Results: Nondepressed elderly Taiwanese respondents had a longer life expectancy than depressed respondents. Furthermore, elderly individuals who had regular social participation were found to have an additional 0.7–1.3 years of life expectancy, an additional 1.2–2.4 years of healthy life expectancy, and 0.5–1.1 fewer years of unhealthy life expectancy.

Conclusion: The results of this research suggest that the public should be encouraged to attend social activities regularly. This study also provides references for policy makers to address this issue.

1. Introduction

There has been an increase in the aging population worldwide, and Taiwan is no exception. According to the Ministry of the Interior in 2009, the number of people aged 65 years and older in Taiwan was 2,478,560, or 10.71% of the total population[1]. Today, the elderly in Taiwan are quite different from those in the past.

They seek not only a longer duration but also a better quality of life. Health-related problem, physical or mental, has been identified to be associated with one's quality of life worldwide[2–4], especially among the elderly population[5,6]. Therefore, it is crucial to understand the factors influencing health to improve quality of life for the elderly in Taiwan.

Life expectancy (LE), which consists of healthy life expectancy (HLE) as well as unhealthy life expectancy (Un-HLE), has been identified as an important health indicator. The World Health Organization (WHO) defines LE as "the average number of years a person can be expected to live", whereas HLE "estimates the equivalent years in full health that a person can be expected to live on the basis of the current mortality rates and prevalence distribution of health states in the population."[7] According to the country comparison of overall LE at birth released by CIA in the United States, of the 221 countries, Monaco had the longest overall LE at birth of 89.73 years, Angola had the shortest overall LE at birth of 38.76 years in 2011, and Taiwan was ranked 51st for the highest overall LE at birth of 78.32 years[8].

LE, HLE, and Un-HLE are essential indicators for measuring the status of health, especially mental health. For example, several studies have addressed the effect of depression on LE. Zhang modeled the relationship between longitudinal changes in depressive symptoms and mortality in a sample of community-dwelling elderly people in the United States[9]. The study concluded that an annual increase of 1 point in Center for Epidemiologic Studies Depression Scale (CES-D) scores was associated with a 57% higher risk of mortality (HR = 1.57, $p < 0.001$) at follow-up. Another study examined the impact of obesity on LE in older Americans[10]. The authors concluded that obesity had little effect on LE for men or women aged 70 years or older. However, in this age range, HLE was significantly shorter whereas Un-HLE was significantly longer for obese people.

☆ All contributing authors declare no conflict of interest.

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1873-9598/$ – see front matter
http://dx.doi.org/10.1016/j.ijge.2012.07.001

In addition to LE, HLE, and Un-HLE, social participation is an essential determinant of health. Social participation is confirmed to have a positive effect on self-rated health by sex and gender. Lee et al[11] reported that women who were more involved in social activities tended to rate their own health better than men did. In addition, the influence of social participation on health status increased with age.

Social participation has been determined to benefit both physical and psychological health. Several studies have confirmed a positive effect of social participation on physical health[12,13]. Social participation was also confirmed to have a strong influence on psychological well-being[14], especially depression[15,16]. According to Hong et al's study in 2009, specific activities, such as volunteering, exercise, self-perception of social activity level, and greater participation in social activity, were associated with longitudinal changes in depression. Social participation has also been determined to have a positive effect on mental health in studies in Taiwan. Chen examined the effect of a "social service" intervention activity for community-dwelling elders on mental health and life satisfaction in 2009[17]. The results of the study showed that participation in "social services" affected mental health and life satisfaction among elders in Taiwan.

Associations have been confirmed between an individual's health and LE, HLE, Un-HLE, and social participation, but there is little published evidence on the effect of social participation on LE, HLE, and Un-HLE among the elderly in Taiwan. Furthermore, little published empirical research has targeted the effects of mental health on LE among this specific population. Therefore, the present study was conducted in two phases. The first phase addressed the relationship between longitudinal changes in depressive symptoms and LE, and the second phase estimated the effect of social participation on HLE or Un-HLE. The purpose of this study was to examine the effect of depressive symptoms on LE late in life as well as to estimate the average number of years that elderly Taiwanese people can be expected to live, with and without social participation. This research aimed at finding answers to the following queries: (1) whether depressive symptoms affect LE and HLE, and (2) whether social participation affects LE, HLE, and Un-HLE among elderly Taiwanese people.

2. Methods

2.1. Sample

Data were obtained from the "Surveys of Health and Living Status of the Elderly in Taiwan" (SHLSE), which was a component of the Bureau of Health Promotion of the Department of Health in Taiwan. This was a population-based, longitudinal study of a nationally representative random sample of older adults (aged 60 years and more), which was conducted in 1996, 1999, and 2003. Details of this study design had been described by Zimmer et al[18] and Hsu[19]. Inclusion criteria for this study were as follows: (1) Taiwanese elderly people aged 65 years or older in 1996, (2) no cognitive impairment, (3) the ability to speak or read Mandarin or Taiwanese, and (4) noninstitutionalized. The Short Portable Mental Status Questionnaire was applied to exclude the participants with cognitive impairment.

2.2. Design

A longitudinal national survey with a multistage national probability sampling method was applied in this study. Taiwan maintains a household register system for each resident; elderly Taiwanese aged 60 years or more (in 1996) were then randomly selected and invited to participate in this study based on this system. Data were collected at three time points: in 1996 (Wave 1), 1999 (Wave 2), and 2003 (Wave 3). First, 331 out of 361 administrative units (townships) in Taiwan were selected in Wave 1. Then, these 331 administrative units (townships) were divided into 27 strata of similar, equal population sizes based on three levels of urbanization, three levels of education, and three levels of the total fertility rate. A total of 56 administrative units (townships) were finally selected. Second, a selection of blocks (neighborhoods) was made within each selected administrative unit (township) according to the relative population size of the administrative unit (township) with respect to the entire population. Finally, two eligible participants were selected for interview, by systematic random sampling, from each of the selected blocks (neighborhood). A total of 2599 people completed the Wave 1 (response rate = 89.3%) in 1996. Samples included in this study were the initial cohort during 1996 and its follow-ups in 1999 and 2003, with sample sizes of 2599, 2149, and 1566, respectively (Fig. 1). Deaths of the participants were also recorded and verified with official death registration records.

2.3. Measures

A short-form of the CES-D was applied to measure depressive symptoms. Ten questions were included in this scale. Each question was scored from 0 (rarely) to 3 (most or all of the time). The 9th and 10th questions had reversed scores, with 0 indicating "most or all of the time" and 3 indicating "rarely." The total scores for this scale ranged from 0 to 30, with a cutoff point of 10. A higher score represented a tendency toward more depression symptoms.

CES-D is a widely used scale in the nursing field, with a Cronbach's α of 0.79–0.86[20,21].

In this research, LE was defined as "years of life that one is able or has limited difficulties to independently perform any of the activities in the health index," HLE as "years of life that one is disability-free and has the ability to fully perform any of the activities in the health index," and Un-HLE as "years of life that one has limited ability to independently perform any of the activities in the health index."

Social participation was defined in this study as "daily activity, formally or informally." To measure social participation, the question "Did you participate in social activities or clubs regularly (at least once per month during the past 12 months)?" was asked

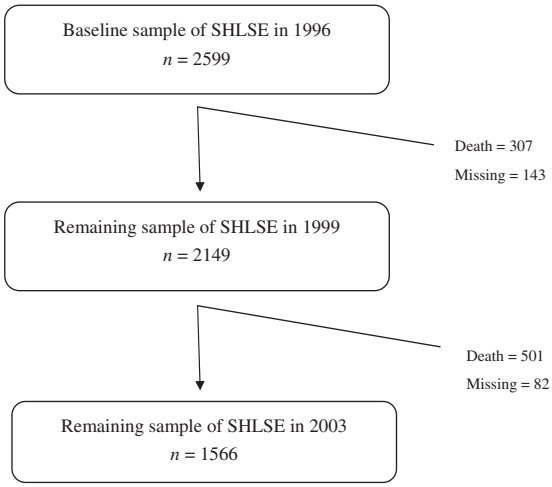

Fig. 1. Process of sample selection for the SHLSE in Taiwan. SHLSE = Surveys of Health and Living Status of the Elderly.

during the first wave of the survey in 1996. The question was dichotomized into "yes" or "no" responses. Participants who answered "yes" were identified as actively involved in social participation.

2.4. Analysis

The Interpolation Markov Chain (IMaCh) developed by Brouard and Lièvre, which is based on multinomial logistic regression, was used for data analysis. IMaCh program was applied to deal with many waves of data together and at different lengths of intervals between surveys. Furthermore, it was also used for calculating HLE as well as Un-HLE for a single-year age by other covariates, such as depression. As a result, estimates of total LE, HLE, and Un-HLE for elderly Taiwanese with or without social participation were determined. The estimated LE at Wave 1 was also included with each 5-year interval of age.

3. Results

3.1. Demographic data

A total of 2599 participants, including 1454 males (55.9%) and 1145 females (44.1%), were recruited in the first wave of the survey. Most of the participants were between the ages of 70 and 74 years (35.9%); 21 participants (0.8%) were older than 90 years.

Both older male and female patients had a low level of education, with three-fourths of older females lacking formal education. Less than 10% of the participants had more than 7 years of education. In addition, less than half of the study participants (1220, 46.9%) stated that they engaged in regular social participation.

Among these participants, 808 (66.2%) were male and 412 (33.8) were female.

3.2. Depression

The results of the health transitions for depressive symptoms are presented in Table 1. Of a total of 2599 participants, 1929 (74.2%), 1683 (76.2%), and 1241 (79.2%) were free from depressive symptoms, whereas 670 (25.8%), 511(23.8%), and 325 (20.8%) indicated to have depressive symptoms in Waves 1, 2, and 3, respectively.

To answer research question 1, participants were categorized as "depressed" (presenting depressive symptoms in Wave 1) or "nondepressed" (free from depressive symptoms in Wave 1) (Table 2). In the depressed group, the average LE ranged from16.4 years at age 65–69 to 4.5 years at age 85 or older, and the average HLE ranged from 10.9 years at age 65–69 to 1.6 years at age 85 or older. The proportion of HLE in the total LE ranged from 66.5% at age 65–69 to 35.6% at age 85 or older in the depressed group.

In the nondepressed group, the average LE ranged from 17.4 years at age 65–69 to 5.7 years at age 85 or older, the average HLE ranged from 14.2 years at age 65–69 to 4.7 years at age 85 or older, and the proportion of HLE in the total LE ranged from 81.6% at age 65–69 to 82.5% at age 85 or older. The results revealed that nondepressed elderly Taiwanese tended to have a longer life span.

Table 1
Health transitions of depressive symptoms ($n = 2599$).

	Wave 1 (1996)	Wave 2 (1999)	Wave 3 (2003)
Depression free	1929	1638	1241
Depressed	670	511	325
Dead		307	808
Missing		143	225

Table 2
Proportion of HLE for depressed versus nondepressed people in 1996.

Age (y)	Depression free			Depressed		
	LE	HLE	%HLE	LE	HLE	%HLE
65–69	17.4	14.2	81.6	16.4	10.9	66.5
70–74	13.6	11	80.9	12.4	7.5	60.5
75–79	10.4	8.5	81.7	9	4.9	54.4
80–84	7.8	6.3	80.8	6.4	2.9	45.3
85↑	5.7	4.7	82.5	4.5	1.6	35.6

HLE = healthy life expectancy; LE = life expectancy.

Comparing the LE and the HLE between the depressed and nondepressed group of participants, the nondepressed participants could expect 1–1.4 more years of LE and 3.1–3.6 more years of HLE than depressed participants.

3.3. Life expectancy

The estimated LE, HLE, and Un-HLE are presented in Table 3. The average LE ranged from 17.2 years at age 65–69 to 3.9 years at age 90 or older. The proportion of HLE to LE ranged from 79.7% at age 65–69 to 71.8% at age 90 or older.

3.4. Social participation

In 1996 (Wave 1), 1379 (53.1%) participants indicated that they were not actively involved in social participation, whereas 1220 (46.9%) participants indicated active involvement in social participation. In addition, social participation was also grouped by gender. The results showed that 808 (55.6%) male participants were actively involved in social participation, whereas only 412 (36%) female participants were actively involved in similar activity.

Social participation was examined to explore whether it affected LE, HLE, and Un-HLE. As shown in Table 4, social participation had strong effects on LE, HLE, and Un-HLE in the age range 65–80 ($p < 0.001$), and slight effects on HLE and Un-HLE at age 85 or older. The differences in LE, HLE, and Un-HLE for each age group were also examined, with and without social participation. For example, at age 65–69, Taiwanese elderly with social participation had 1.3 more years of LE and 2.4 more years of HLE, but 1.1 fewer years of Un-HLE than those without social participation.

4. Discussion

There were two phases of this research. In the first phase, longitudinal changes in depression showed a decline over the years of this research. The incidence rate of depression decreased by 2.0% from Wave 1 to Wave 2 and decreased by 3.0% from Wave 2 to Wave 3. These results indicated that, with social and economic changes, depression in older people in Taiwan diminished over time. Further research must be conducted to explore this phenomenon. In addition, the results of this research indicated that depressive

Table 3
Proportion of estimated HLE in 1996.

Age (y)	LE	HLE	Un-HLE	%HLE
65–69	17.2	13.7	3.6	79.3
70–74	13.4	10.5	3.0	77.9
75–79	10.1	7.7	2.4	76.2
80–84	7.45	5.5	1.9	74.5
85–89	5.4	3.9	1.5	72.5
90↑	3.9	2.8	1.2	70.3

HLE = healthy life expectancy; LE = life expectancy; Un-HLE = unhealthy life expectancy.

Table 4
Effect of social participation on LE, HLE, and Un-HLE.

SP age (y)	LE	Participation						Nonparticipation				
		SE	HLE	SE	Un-HLE	SE	LE	SE	HLE	SE	Un-HLE	SE
65–69	17.9	0.409***	14.9	0.404***	3.0	0.214***	16.6	0.361***	12.5	0.372***	4.1	0.238***
70–74	14.0	0.380***	11.5	0.362***	2.5	0.188***	12.9	0.323***	9.5	0.311***	3.4	0.199***
75–79	10.6	0.359***	8.6	0.338***	2.1	0.177***	9.7	0.300***	7.0	0.283***	2.7	0.188***
80–84	7.8	0.340***	6.2	0.322***	1.6	0.175***	7.1	0.284***	5.0	0.272***	2.2	0.192***
85–89	5.7	0.311	4.4	0.303*	1.3	0.177*	5.1	0.260	3.5	0.261*	1.7	0.202*
90↑	4.1	0.266	3.1	0.277	1.0	0.182	3.8	0.222	2.4	0.250	1.3	0.213

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
HLE = healthy life expectancy; LE = life expectancy; SE = standard error; SP = social participation; Un-HLE = unhealthy life expectancy.

symptoms affected LE and HLE. Older Taiwanese without depressive symptoms could be expected to live 1–1.4 years longer than those with depressive symptoms, and to healthy for live 3.1–3.6 years more than those with depressive symptoms.

The average total LE ranged from 17.2 years at age 65 to 3.9 years at age 90. Several studies have estimated total LE in different countries. The results found in America and China were similar to those found in Taiwan. Research by Crimmins et al[22] in 2009 found a total LE of 14.3 years for the 1994 US population at age 70. Our research found that the total LE at age 70 for Taiwanese elders was 13.4 years in 1996. Liu et al[23] also reported that the total LE in China at age 70 was 11.2 years in 1987 and 11.9 years in 2006.

Unsurprisingly, Japan has the longest total LE. In Konno et al's[24] study, the total LE for Japanese elderly at age 70 was 16.1 years for men and 17.0 years for women during 1998–2002. However, the LE in the Philippines is much shorter.

According to Cruz et al's[25] study, the total LE for Filipino elderly at age 70 was 7.2 years for men and 10.4 years for women in 2000.

According to the results of this research, social participation affected LE, HLE, and Un-HLE of the elderly Taiwanese population. Older individuals with regular social participation had a longer HLE than those without regular social participation. Elderly individuals with regular social participation were found to have an additional 0.7–1.3 years of LE, an additional 1.2–2.4 years of HLE, and 0.5–1.1 fewer years of Un-HLE. In other words, older Taiwanese benefit from social participation if they participate in the social activities regularly; they can expect a longer LE and HLE and a shorter Un-HLE. This finding is consistent with Rubin et al's[26] study in 2009, which concluded that remaining socially active was beneficial for the elderly to maintain an independent life and the functional capacity to perform activity of daily living (ADLs).

This research has some limitations. First, the variable "social participation" was measured by only one question. Since this was a secondary data analysis study, it was difficult to measure different domains. Second, a 10-item CES-D scale instead of a 20-item one was used in this research. Although the short form of the CES-D has not yet widely been used, it was verified to have excellent properties and is recommended for use as a screening instrument to identify depression, especially in the elderly[27,28]. Last, factors influencing people becoming depressed are complicated. For example, people with disability usually have the tendency of depression. In contrast, depressed people may limit their ability to preform ADLs. Since the comorbidity between disability and depression did exist, it is hard to identify the causality among them. Therefore, future research can be done by stratifying depressed people with or without disability to see the difference of their life expectancy; or, stratifying disabled people with or without depression to see the difference of their life expectancy.

There are two recommendations for future policy and practice. First, social participation has been identified to affect LE. Therefore, it is essential to increase accessibility to social activities for the elderly Taiwanese population. More opportunities should be provided to facilitate the social participation of the elderly. Furthermore, it is important to encourage the elderly to participate in social activities. Diverse social activities, such as clubs, educational programs, and volunteering, provide a variety of choices to increase the motivation and fulfill the needs of the elderly population.

Financial support

This study was partially supported by grant csh-2011-D-004 from Chung-Shan Medical University Hospital.

Acknowledgments

We would especially like to thank Professor Yasuhiko Saito for his thoughtful suggestions and recommendations on this study. We would also like to thank the Bureau of Health Promotion, Department of Health in Taiwan, R.O.C., for sharing the data set.

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